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(12) UK Patent Application (19) GB (11) 2 206 253 (13) A

(43) Application published 29 Dec 1988

(21) Application No 8814005

(22) Date of filing 14 Jun 1988

(30) Priority data
(31) 8714325 (32) 18 Jun 1987 (33) GB

(51) INT CL*
H04H 9/00

(52) Domestic Classification (Edition J):
H3Q 200 AR
G4H 13D 14A 1A TJ
U1S 2106 2206 G4H H3Q

(56) Documents cited
None

(58) Field of search
H3Q
Selected US specifications from IPC sub-class
H04H

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(54) A method and apparatus for monitoring video signal receivers

(57) Apparatus for monitoring a video signal receiver (3, Fig 1) capable of being tuned to a plurality of channels to determine if the receiver is tuned to receive one of the plurality of channels comprises a first sensor 17 to sense the synchronisation signal associated with a selected one of the channels, and a second sensor 20 to sense a signal related to the synchronisation signal associated with the video signal to which the video signal receiver (3) is responding. A phase detector 18 determines the phase relationship between the two sensed signals, and a modulator 22 supplies a delayed form of the synchronisation signal sensed by the first sensor 17 to the video receiver (3). A processor 10 determines whether there is then a change in the phase relationship between the two sensed signals.

Fig.2.

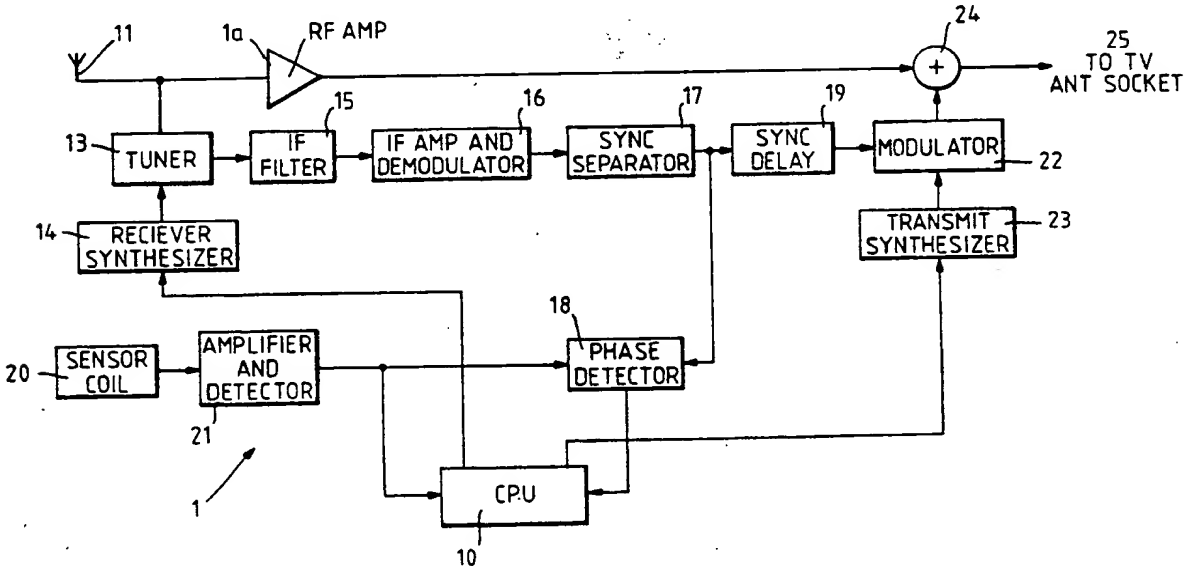

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Fig. 1.

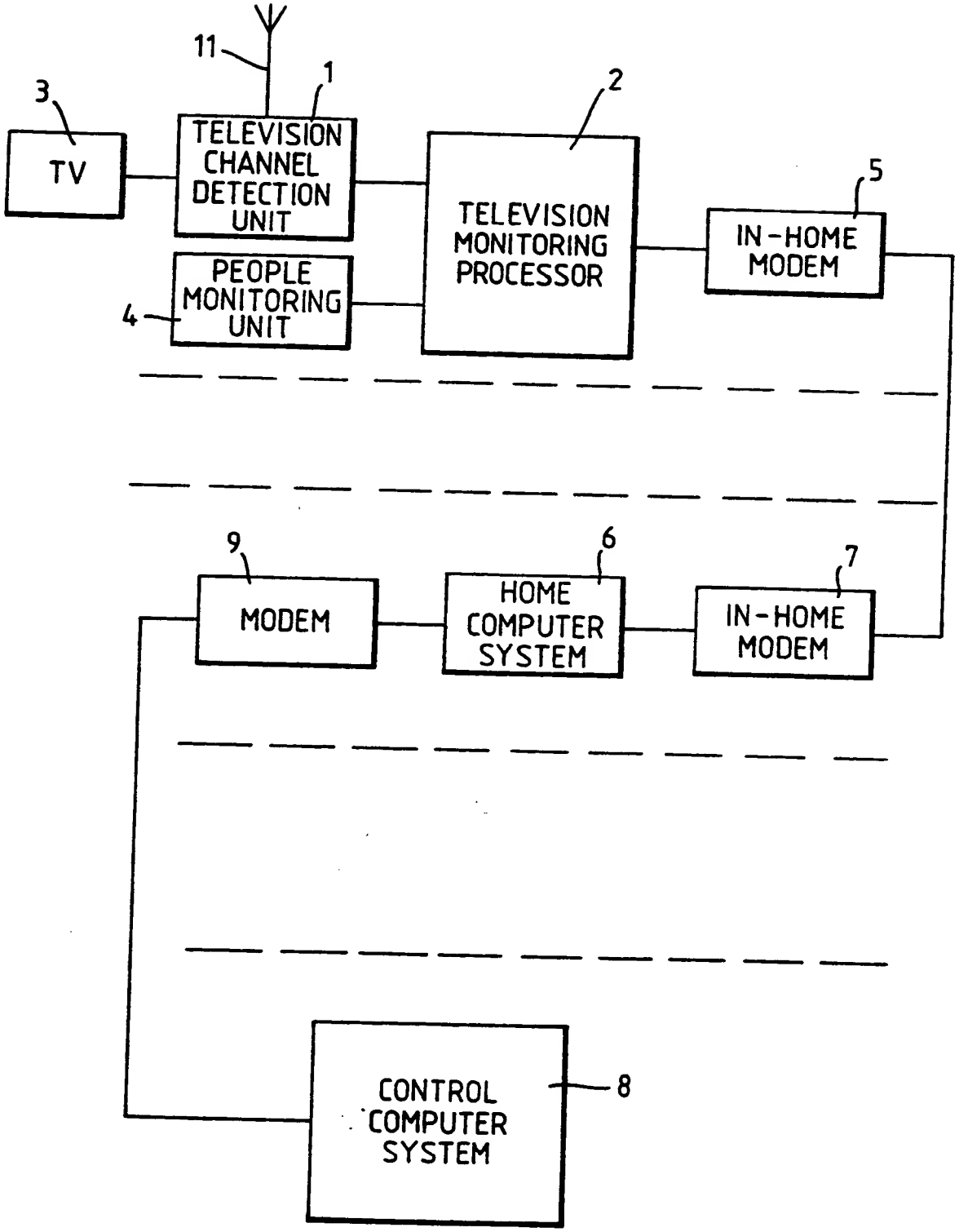
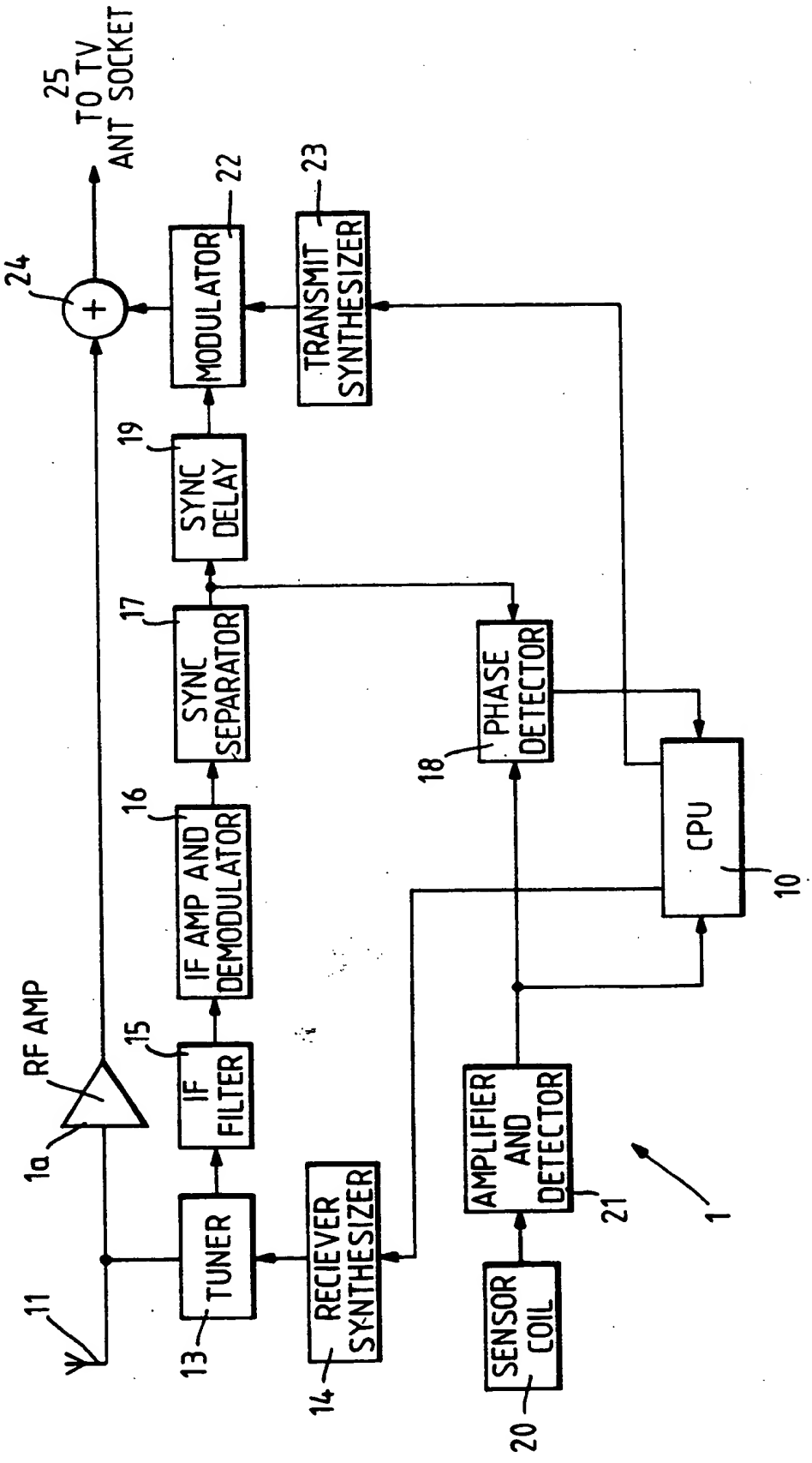


Fig.2.



A method and Apparatus for Monitoring Video Signal Receivers

This invention relates to methods and apparatus for monitoring video signal receivers such as televisions, video cassette recorders and the like.

For the purposes of audience research it is common practice to monitor a video signal receiver to determine the channel to which the receiver is tuned. This is typically achieved by placing pick-up probes within the tuner of the receiver or by making direct electrical connection to the tuning voltage of the variable capacitance tuning diode within the tuner of the receiver.

The requirement to open up the housing of the video receiver and place electrical equipment within the housing is undesirable particularly since firstly the placement of equipment inside the housing usually results in some damage to the video receiver and secondly it is time consuming to make such connections which necessitates the use of skilled personnel.

Channel detection systems have been built that compare the phase of the synchronisation signal associated with the particular channel to that of the line fly-back. These systems are fatally flawed because it is possible for the synchronisation signals of more than one channel to be in phase.

In accordance with a first aspect of the present invention, a method of monitoring a video signal receiver capable of being tuned to a plurality of channels to determine if the receiver is tuned to receive one of the plurality of channels comprises:-

(a) sensing the phase relationship between the synchronisation signal associated with one of the plurality of channels and a signal related to the

synchronisation signal of the video signal to which the video receiver is responding;

(b) supplying to the video signal receiver a delayed form of the synchronisation signal of the one of the plurality of channels modulated onto a carrier signal of that channel at an amplitude substantially greater than that of the received carrier signal of that channel at its point of entry to the video receiver; and,

(c) sensing the phase relationship between the signal related to the synchronisation signal of the video signal to which the video receiver is responding and the synchronisation signal associated with the one of the plurality of channels to determine whether there has been a change in the phase relationship.

If the phase relationship is the same this indicates that the video signal to which the video signal receiver is responding has been unaffected by the delay and so indicates that the video receiver is not tuned to the channel in question. If there has been a change in the phase relationship, however, then this indicates that the channel to which the video receiver is tuned is the one of the plurality of channels.

The invention provides a very simple and convenient way of determining whether the video signal receiver has been tuned to receive the one of the plurality of channels since the signal related to the synchronisation signal can be detected from outside the video signal receiver itself. In the case of a television set, this signal can comprise a magnetic field associated with the line scan which can be detected using a simple coil positioned externally of the television set. Thus, the invention enables a non-invasive monitoring system to be set up.

In accordance with a second aspect of the present invention, apparatus for monitoring a video

signal receiver capable of being tuned to a plurality of channels to determine if the receiver is tuned to receive one of the plurality of channels comprises a first sensor to sense the synchronisation signal associated with a selected one of the channels, a second sensor to sense a signal related to the synchronisation signal associated with the video signal to which the video signal receiver is responding, comparison means for determining the phase relationship between the two sensed signals, modulating means to supply a delayed form of the synchronisation signal sensed by the first sensor to the video receiver, and processing means to determine whether there is then a change in the phase relationship between the two sensed signals.

In some examples, the method and apparatus in accordance with the invention can be used to determine whether the video signal receiver has been tuned to a particular channel. This has applications in the field of pay TV in which the supplier of the video signal is only interested in determining whether the television set has been tuned to the pay TV channel.

The invention is particularly applicable, however, to the general monitoring of video signal receiver usage, for example for the purposes of audience research. In this case, the method further comprises repeating steps (a) - (c) for different ones of the plurality of channels until a change in the phase relationship is detected in step (c).

To achieve this, the first sensor may include tuning means which can be tuned to each of the plurality of channels, and synchronisation signal separating means for receiving the output signal from the tuning means and to generate the synchronisation signal associated with the channel to which the tuning means is tuned.

Conveniently, the modulating means comprises a delay circuit for receiving the synchronisation signal sensed by the first sensor, the output of the delay circuit being fed to a modulator to which is fed a carrier signal corresponding to the one of the channels associated with the synchronisation signal, the output of the modulator being fed to a combiner circuit for combining all the available channels, the power of the modulated carrier being such that the one channel is substantially swamped.

With this arrangement, a new version of the one modulated channel is generated with the delayed synchronisation signal and is simply superimposed on the original modulated carrier to swamp it so that the video signal receiver essentially responds to the new modulated carrier signal.

Conveniently, once the channel to which the video receiver is tuned has been determined, the method further comprises repeating steps (a) - (c) to determine whether the video signal receiver has been retuned.

In one example the steps (a) - (c) may be repeated for each of the plurality of channels. However, in order to reduce disturbance to the user, it is preferable if the steps (a) - (c) are only repeated for those of the plurality of channels different from the previous channel to which the receiver was tuned.

In a further refinement, use can be made of the fact that typically in any plurality of channels, the synchronisation signals associated with each channel will not be in phase with each other. The method may therefore further comprise sensing and storing the phase relationship between the synchronisation signal associated with each of the plurality of channels and the signal related to the synchronisation signal of the video signal to which the video receiver is responding; and,

after a determination has been made as to which channel the video receiver is tuned to, repeating steps (a) - (c) to determine if the channels receiver is tuned to any one of a group of the plurality of channel for which the stored phase relationships are close to the phase relationship determined in step (a).

An example of a method and apparatus for monitoring a video receiver in accordance with the present invention will now be described with reference to the accompanying drawings in which:-

Figure 1 is a block diagram of a television monitoring system; and,

Figure 2 is a block diagram of the television channel detection unit shown in Figure 1.

Figure 1 shows a block diagram of a television monitoring system. The television channel detection unit 1 informs the television monitoring processor 2 of the current channel to which a television set 3 is tuned. The person monitoring unit 4 informs the processor 2 of the people who are watching the television set 3. The processor 2 is linked by an in-home modem 5 to a home computer system 6 via another modem 7.

The in-home computer system 6 stores information received from one or from a plurality of television monitoring processors 2 and forwards the information to a central computer system 8 via a modem 9 and a telephone line. The central computer system 8 collects information from one or, typically a plurality of in-home computer systems 6 and then processes the information to produce television ratings information.

Figure 2 illustrates in more detail a television channel detecting unit 1 which is connected to a television monitoring processor 2. A micro-processor (CPU) 10 in the television channel detecting unit 1 is physically provided by the television monitoring

processor 2 but as the individual tasks run in a time-shared manner the CPU 10 and the television monitoring processor 2 may be considered as logically distinct entities.

The television antenna 11 is connected to a radio frequency amplifier 12 and to a tuner 13. The radio frequency amplifier 12 isolates the antenna 11 and compensates for any system losses. The tuner 13 can be tuned to any of the available television channels by the synthesiser 14 under control of the CPU 10. The output of the tuner 13 is filtered by an intermediate frequency filter 15 the output of which is amplified and demodulated by the amplifier and demodulator 16 and is then fed to the synchronisation separator 17 where the synchronisation signals are separated from the vision signal. The output of the synchronisation separator 17 is fed to a phase detector 18 and to a synchronisation delay circuit 19.

A sensor coil 20 is positioned adjacent the television 3 to pick up the magnetic field from the line scan circuitry of the television 3 which oscillates at a frequency which is substantially constant relative to the synchronisation signal of the channel to which the television is tuned. The output of the sensor coil 20 is fed to the amplifier and detector 21 which provides the phase detector 18 with a signal which has a fixed phase relationship with the synchronisation signal of the channel to which the television is tuned. The amplifier and detector 21 also provides an output to the CPU 10 that indicates when line scan radiation is being received by the sensor coil 20. The CPU 10 can measure the phase difference between the signal picked up by the sensor coil 20 and the synchronisation signal of any of the available television channels by appropriately tuning the

synthesiser 14 and observing the output of the phase detector 18.

The synchronisation delay circuit 19 delays the output of the synchronisation separator 17 and feeds the delayed signal to the modulation input of the modulator 22. The modulator 22 can be tuned by the transmit synthesiser 23 to the carrier frequency of any of the available television channels under the control of the CPU 10. The output of the modulator 22 is combined with the output of the radio frequency amplifier 12 by the passive splitter 24 and is fed into the antenna socket 25 of the television 3.

In operation the CPU 10 determines if the television set 3 is switched on by observing the output of the sensor coil 20. The CPU 10 then takes each of the available television channels in sequence and measures the phase difference between the synchronisation signal of the chosen channel and the signal from the sensor coil 20. The CPU 10 then tunes the modulator 22 to the chosen channel and injects a signal into the television antenna socket 25 on that channel at a sufficiently high level to swamp the output from the radio frequency amplifier 12 on the chosen channel. The CPU 10 then remeasures the phase difference and if it finds that the phase difference remains unchanged it moves onto the next channel. If the CPU 10 finds that the phase difference has changed by the delay of the synchronisation delay circuit 19 then the television must be tuned to that channel. Once the CPU 10 has established the channel to which the television 3 is tuned it switches off the modulator 22 in order to restore the picture to the television.

Once the CPU 10 has positively identified the tuned channel it must periodically confirm that the tuned channel has not changed. It should not do so by turning

on the modulator 22 tuned to that channel because to do so would result in periodic disturbance to the picture. The CPU 10 therefore checks if the television is tuned to any other available channel. If the CPU 10 finds that the television is not tuned to any other channel it assumes it still to be tuned to the original channel.

The operating procedure described above can be improved because the synchronisation signals of different channels will usually not be in phase at the antenna. Once the phase relationship between the synchronisation signal of a channel that is being viewed and the output of the sensor coil 20 has been established this known synchronisation to sensor delay time can be used to reduce the number of channels that have to be searched in the manner that has been described above.

In this mode of operation the CPU 10 first checks each available channel to establish the phase relationship of that channel's synchronisation signal to the output of the sensor coil 20. The CPU 10 then selects a set of channels which have a phase relationship close to the known synchronisation to sensor delay time (the ambiguity set). The CPU 10 then injects a carrier with a delayed synchronisation signal for each channel in the ambiguity set to establish the channel to which the television has been tuned as has been described above. Once the channel has been determined it is only necessary to sequence through the other channels in the ambiguity set to determine the channel to which the television is tuned. Should the television be tuned to a new channel not in the ambiguity set the CPU 10 determines a new ambiguity set and the channel search proceeds as has been described above.

Although the invention has been explained in connection with the monitoring of television sets it could also be used with modification for the monitoring

of related devices such as video cassette recorders, cable convertors, satellite receivers and the like, by modifying the way in which the synchronisation signal in the video output of the device is determined.

In the case of cable convertors or satellite receivers this can be achieved by demodulating the output signal or by monitoring the signal on the television set or video cassette recorder which is tuned to its output. In the case of a video cassette recorder a video output is normally provided which can be directly monitored.

In a further refinement the modulator only feeds a signal to the combiner circuit during the vertical blanking interval of the video receiver. The response of the video receiver is determined during the vertical blanking interval and the output from the modulator is disabled before the end of the vertical blanking interval so that the video receiver is able to resynchronise to the horizontal sychronisation signal of the channel to which it is tuned before the end of the vertical blanking interval. By this means it is possible to determine if a video signal receiver is tuned to a particular channel without any visible disturbance to the picture.

This method may be combined with the refinements mentioned earlier to reduce the number of channels that need to be searched by injecting a modulated carrier signal into the input of the video receiver. In the case of a video receiver without an associated video display, for example a video cassette recorder, the vertical blanking interval referred to is that of the associated video display device with the shortest vertical blanking interval.

CLAIMS

1. A method of monitoring a video signal receiver capable of being tuned to a plurality of channels to determine if the receiver is tuned to receive one of the plurality of channels, the method comprising

(a) sensing the phase relationship between the synchronisation signal associated with one of the plurality of channels and a signal related to the synchronisation signal of the video signal to which the video receiver is responding;

(b) supplying to the video signal receiver a delayed form of the synchronisation signal of the one of the plurality of channels modulated onto a carrier signal of that channel at an amplitude substantially greater than that of the received carrier signal of that channel at its point of entry to the video receiver; and,

(c) sensing the phase relationship between the signal related to the synchronisation signal of the video signal which to the video receiver is responding and the synchronisation signal associated with the one of the plurality of channels to determine whether there has been a change in the phase relationship.

2. A method according to claim 1, wherein the signal related to the synchronisation signal of a video signal to which the video receiver is responding comprises a magnetic field associated with the line scan.

3. A method according to claim 1 or 2, further comprising repeating steps (a) - (c) for different ones of the plurality of channels until a change in the phase relationship is detected in step (c).

4. A method according to claim 3, wherein the steps (a)- (c) are only repeated for those of the plurality of channels different from the previous channel to which the receiver was tuned.

5. A method according to any of the preceeding claims, wherein once the channel to which the video receiver is tuned has been determined, the method further comprises repeating steps (a) - (c) to determine whether the video signal receiver has been retuned.

6. A method according to any of the preceeding claims, further comprising sensing and storing the phase relationship between the synchronisation signal associated with each of the plurality of channels and the signal related to the synchronisation signal of the video signal to which the video receiver is responding; and, after a determination has been made as to which channel the video receiver is tuned to, repeating steps (a) - (c) to determine if the receiver is tuned to any one of a group of the plurality of channels for which the stored phase relationships are close to the phase relationship determined in step (a).

7. Apparatus for monitoring a video signal receiver capable of being tuned to a plurality of channels to determine if the receiver is tuned to receive one of the plurality of channels, the apparatus comprising a first sensor to sense the synchronisation signal associated with a selected one of the channels, a second sensor to sense a signal related to the synchronisation signal associated with the video signal to which the video signal receiver is responding, comparison means for determining the phase relationship between the two sensed signals, modulating means to supply a delayed form of the synchronisation signal sensed by the first sensor to the video receiver, and processing means to determine whether there is then a change in the phase relationship between the two sensed signals.

8. Apparatus according to claim 7, wherein the first sensor includes tuning means which can be tuned to each of the plurality of channels, and synchronisation signal

separating means for receiving the output signal from the tuning means and for generating the synchronisation signal associated with the channel to which the tuning means is tuned.

9. Apparatus according to claim 7 or claim 8, wherein the modulating means comprises a delay circuit for receiving the synchronisation signal sensed by the first sensor, the output of the delay circuit being fed to a modulator to which is fed a carrier signal corresponding to the one of the channels associated with the synchronisation signal, the output of the modulator being fed to a combiner circuit for combining all the available channels, the power of the modulated carrier being such that the one channel is substantially swamped.

10. A method of monitoring a video signal receiver substantially as hereinbefore described with reference to the accompanying drawings.

11. Apparatus for monitoring a video signal receiver substantially as hereinbefore described with reference to the accompanying drawings.

Published 1988 at The Patent Office, State House, 66/71 High Holborn. London WC1R 4TP. Further copies may be obtained from The Patent Office, Sales Branch, St Mary Cray, Orpington, Kent BR5 3RD. Printed by Multiplex techniques ltd, St Mary Cray, Kent. Con. 1/87.